IDENTIFICATION OF Escherichia coli BACTERIA IN DUG WELLS IN KOTA TIMUR DISTRICT OF GORONTALO CITY

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ABSTRACT

Well water is the main water source for providing clean water for people living in rural and urban areas. This well water is easily contaminated by disease-causing agents, especially Escherichia coli and other Colliform bacteria if the well is not made according to requirements.At a distance of less than 10 meters from the source of pollution, wells can be contaminated with human feces (feces) which contain bacteria, namely Escherichia coli, or the cause of water borne disease, namely diarrhea. Therefore, it is advisable to make a well at a distance of more than 10 meters so that the well is protected from various kinds of pollution that might seep into the well. Well spacing that does not meet health requirements makes it very possible to breed pathogenic bacteria that cause waterborne diseases.The purpose of this study was to identify Escherichia coli bacteria in dug wells owned by residents of Kota Timur District in Gorontalo.

This research method uses *cross sectional*where sampling is done one time at the same time. Examination by direct identification with growth on Nutrient Broth (NB) media, Eosin Methylene Blue Agar (EMBA), Sulfide Indol Motility (SIM), MR-VP, SCA and TSIA and gram staining to determine the presence or absence of Escherichia coli bacteria in water Dug wells.

The results obtained from the fifteen samples that were examined did not show positive signs of Escherichia coli. It can be concluded that there was no dug well water that showed the presence of Escherichia coli, but found colonies of pink to purplish pink which were suspected of non-faecal coliform in dug well water in Kota Timur District of Gorontalo.

Keywords: dug well, *Escherichia coli.*

INTRODUCTION

For human life, water is one of the natural resources which has a very important role. Water is also a need that cannot be postponed. Humans need water, especially for drinking as well as for daily human activities such as bathing, cooking, washing clothes and washing kitchen utensils [1].

The quality of clean water that meets the requirements has a very important role in the framework of maintaining, protecting and enhancing the health status of the community [12]. Whereas in addition to meeting the quantity requirements, the provision of drinking water for the community must also meet the quality requirements which include physical requirements, chemical

requirements, radiological requirements and bacteriological requirements [8].

One of the water sources that is often used by the community is dug well water. Dug well water is shallow groundwater to a depth of less than 30 meters, well water is generally at a depth of 15 meters and is also known as free ground water because the groundwater layer is not under pressure. Water sources that come from dug wells are relatively close to the surface of the ground, therefore they are easily exposed to contamination through seepage from various contaminant sources, namely human feces, animal feces, household domestic waste and seepage from garbage piles [15].

At a distance of less than 10 meters from the source of pollution, wells can be contaminated with human feces (feces) which contain bacteria, namely Escherichia coli, or the cause of water borne disease, namely diarrhea [2].

Escherichia coli are bacteria that normally exist in the intestines of humans or animals. *Escherichia coli* is used as an indicator to assess whether or not the water supply for household use is good. While water that has been contaminated with feces can cause various digestive diseases such as cholera, typhus, dysentery, intestinal worms and others with diarrhea symptoms [15].

Diarrhea ranks fifth of the ten diseases that cause death in the world. Year 2018 from 34 provinces [17]. Gorontalo is one of the provinces with the highest number of diarrhea cases with a percentage of 6.4% while the highest number with a percentage of 8.5% is Aceh [13]. Diarrhea cases in Gorontalo City are 7.6% when viewed from Puskemsas, Puskesmas Kota Timur is the largest place with 173 cases of diarrhea in 2018 and 193 cases of diarrhea in 2020 [10].

Based on previous research, 12 samples were positive for Escherichia coli and all did not meet the requirements because they had exceeded the threshold value [3].

RESEARCH METHODS

This type of research is a descriptive observational research that aims to describe the presence of Escherichia coli bacteria in dug well water in Kota Timur Gorontalo sub-district, with a quantitative approach. The design used in this study is a cross sectional study design in which sampling is done once at the same time.

The sample in this study were all wells located in the area of Kota Timur District, namely 14 samples. The sampling used in this study is the cluster random sampling technique. where the researcher divides the population into several groups based on the village, then the researcher selects several samples according to the inclusion criteria:

1. Wells that are still used for daily needs.
2. The well that is close to the source of the contamination (livestock pens, septic children, household waste disposal) is less than 10 meters away.

The data from the research results from the identification of Escherichia bacteria in Dug Well Water in Kota Timur Gorontalo District were analyzed descriptively in the form of a table to explain the data or data characteristics objectively and systematically from the sample studied.

RESEARCH RESULT

Distribution of observation results dug well water samples on NB media.

Table 1. Dug well water sample observation

No	Sampel code	Result on Media NB	Information
1.	S.I	Yellow, Cloudy	Growing bacteria
2.	S.II	Yellow, Cloudy	Growing bacteria
3.	S.III	Yellow, Cloudy	Growing bacteria
4.	S.IV	Yellow, Cloudy	Growing bacteria
5.	S.V	Yellow, Cloudy	Growing bacteria
6.	S.VI	Yellow, Cloudy	Growing bacteria
7.	S.VII	Yellow, Cloudy	Growing bacteria
8.	S.VIII	Yellow, Cloudy	Growing bacteria
9.	S.IX	Yellow, Cloudy	Growing bacteria
10.	S.X	Yellow, Cloudy	Growing bacteria
11.	S.XI	Yellow, Cloudy	Growing bacteria
12.	S.XII	Yellow, Cloudy	Growing bacteria
13.	S.XIII	Yellow, Cloudy	Growing bacteria

14.	S.XIV	Yellow, Cloudy	Growing bacteria

Source: Primary data, 2020

Based on the research that has been done, 14 samples were obtained, put into NB fertilizing media, incubated for 24 hours at 37ºC. Fifteen samples showed the same signs, namely cloudiness and odor, indicating positive results that the fifteen samples of NB were grown by bacteria.

Distribution of observations on EMBA

Table 2. Observation results on EMBA media

No	Sampel code	Coloni traits on EMBA media	A metallic green color	Keterangan
1	S.I	Round, pink	No	Negative *E. coli*
2	S.II	Round, pink	No	Negative *E. coli*
3	S.III	Round, purplish pink	No	Negative *E. coli*
4	S.IV	Round, purplish pink	No	Negative *E. coli*
5	S.V	Round, pink	No	Negative *E. coli*
6	S.VI	Round, pink	No	Negative *E. coli*
7	S.VII	Round, pink	No	Negative *E. coli*
8	S.VIII	Round, pink	No	Negative *E. coli*
9	S.IX	Round, pink	No	Negative *E. coli*
10	S.X	Round, purplish pink	No	Negative *E. coli*
11	S.XI	Round, purplish pink	No	Negative *E. coli*
12	S.XII	Round, pink	No	Negative *E. coli*
13	S.XIII	Round, purplish pink	No	Negative *E. coli*
14	S.XIV	Round, purplish pink	No	Negative *E. coli*

Source: Primary data, 2020

To find out E. coli. the transfer was carried out from the NB media to the EMBA media. The positive results of the samples on the NB media were transferred to EMBA media which was incubated for 24 hours at 37ºC to selectively determine the E. coli bacteria. Of all the absent samples (0%), the samples were metallic green which indicated the presence of E. coli.

Distribution of the results of observations

Table 3. Physical quality of dug well water

No	Sampel code	Kualitas Fisik		
		Smell	Color	Taste
1	S.I	No smell	Clear	Bargain
2	S.II	No smell	Clear	Bargain
3	S.III	No smell	Clear	Bargain
4	S.IV	No smell	Clear	Bargain
5	S.V	No smell	Clear	Bargain
6	S.VI	No smell	Clear	Bargain
7	S.VII	No smell	Clear	Bargain
8	S.VIII	No smell	Clear	Bargain
9	S.IX	No smell	Clear	Bargain
10	S.X	No smell	Clear	Bargain
11	S.XI	No smell	Clear	Bargain
12	S.XII	No smell	Clear	Bargain
13	S.XIII	No smell	Clear	Bargain
14	S.XIV	No smell	Clear	Bargain

Source: Primary data, 2020

Based on the research conducted to see the physical quality of dug well water in Kota Timur Gorontalo District, there were 14 water samples with a distinctive color, namely clear water, 14 water samples that had a distinctive taste of water, namely fresh water, and 14 water samples that had no odor.

Distribution results of measurements

Table 4. Distance from scatter sources

No	Sampel code	Well Distance From Pollutant Sources (meters)			Ministry of Health Standards (10 M from Pollutant Source Distance)
		Septic-tank	Cage	Household waste	
1	S.I	3,30	-	-	Not eligible
2	S.II	2,10	-	-	Not eligible
3	S.III	1,80	-	-	Not eligible
4	S.IV	-	8,20	-	Not eligible
5	S.V	4,80	-	-	Not eligible
6	S.VI	4,80	-	-	Not eligible
7	S.VII	6,30	-	-	Not eligible
8	S.VIII	6	-	-	Not eligible
9	S.IX	5,80	-	-	Not eligible
10	S.X	-	-	3,30	Not eligible
11	S.XI	8,30		-	Not eligible
12	S.XII	-	-	3,40	Not eligible
13	S.XIII	-	-	4,30	Not eligible
14	S.XIV	-	-	5	Not eligible

Source: Primary data, 2020

Based on research conducted to see the distance between wells and pollutant sources, from 14 samples all samples do not meet the requirements, it can be seen that all wells have a distance of less than 10 meters. With 9 well septic tank pollutant sources, 4 well samples adjacent to household waste, and 1 well sample adjacent to the cage.

DISCUSSION

One of the water sources that is often used by the community is dug well water. Dug well water is shallow groundwater to a depth of less than 30 meters and a minimum depth of 15 meters depending on spring conditions. Well water is generally at a depth of 15 meters and is also known as free ground water because the groundwater layer is not under pressure [15].

At a distance of less than 10 meters from the source of pollution, wells can be contaminated with human feces (feces) which contain bacteria, namely Escherichia coli, or the cause of water borne disease, namely diarrhea. Therefore, it is advisable to make a well at a distance of more than 10 meters so that the well is protected from various kinds of pollution that might seep into the well. Well spacing that does not meet health requirements makes it very possible to breed pathogenic bacteria that cause waterborne diseases [2]

*Escherichia coli*is a member of the normal intestinal flora which plays an important role in the synthesis of vitamin K, conversion of bile pigments, bile acids and absorption of food substances. Escherichia coli belongs to heterotrophic bacteria which obtain food in the form of organic substances from their environment because they cannot compile the organic substances they need. Organic matter is obtained from the remains of other organisms. These bacteria break down the organic substances in food into inorganic substances, namely CO2, H2O, energy, and minerals [6].

EMBA media is a selective medium for the isolation of Escherichia coli bacteria. EMBA contains lactose carbohydrates, in the presence of these carbohydrates, the color before fertilization of bacteria on the EMBA medium is purplish red. The color change to metallic green in this media is because the Escherichia coli bacteria can ferment lactose which increases the acid level in the media. High acid levels can precipitate methylene blue in EMBA media [5].

EMBA media can be used for the isolation and differentiation of enteric or Coliform bacteria. EMBA media contains lactose so that it can distinguish between types of bacteria with the ability to ferment lactose, bacteria that can ferment lactose, one of which is Escherichia coli. metal. Apart from Escherichia coli, the bacteria Enterobacter aerogenes and Klebsiella sp can also ferment lactose but not as fast as Escherichia coli because the bacteria Enterobacter aerogenes and Klebsiella sp have weak acid production properties so that the colony formed is pink in accordance with the acidic properties that are formed. [14]

Based on the results of research on bacterial identification *Escherichia coli* on dug well water in Kota Timur District, regarding the presence or absence of Escherichia coli bacteria that are present dug well water in Kota Timur District. Overall sampledug well water in Kota Timur District The results show that there is no or the water is not contaminated with Escherichia coli bacteria because of the 14 samples there is no metallic green color change in the media. but pink to purplish pink.

Previous research conducted in pink to purplish pink color indicates the presence of Enterobacter aerogenes and Klebsiella bacteria which have the ability to ferment lactose which is not as fast as Escherichia coli bacteria with weak acid production so that the growing colonies are pink to purplish pink in color. of Eosin [6].

The well distance is at least 10 meters from pollutant sources. The distance between sources of pollutants and wells has an effect, from the results of observations from 14 that all wells do not meet the requirements where all wells have a distance less than 10 meters from the pollutant source. However, based on research negative results of Escherichia coli were found. this can happen. Construction of a septic tank if it is not located on sandy soil, the bacteria do not easily pass through the soil's pores [15].

Previous research has stated that the construction of wells must follow health standards, construction of wells that do not meet the requirements will make it easier for bacteria to infiltrate and enter

the well [9]. The physical condition of wells can affect water pollution in dug wells, where the better the physical condition of the well the less the bacteriological quality of dug well water, conversely if the worse the physical condition of the dug well, the bacteriological quality of the well water is getting worse [11].

Escherichia coli was not found because it was based on the results of observations made in Kota Timur District seen from the physical construction of the well. The results of field observations obtained 14 dug wells which have a dug well wall structure that uses walls made of watertight cement. The average wells have no gaps and cracks. This is in line with previous research where contaminated wells were caused by well construction made without concrete, this causes well water to be polluted through seepage of soil pores, thus affecting the quality of well water [15].

Another factor that causes the well water to not be contaminated is due to the condition of the well lip, from the direct observation that 14 samples of dug wells have a lip where the well lip is made of a watertight wall apart from the lip of the well, the floor of the well is made of watertight walls and is slightly tilted. with a little hole in the corner. Dug wells must be supported by construction requirements for the construction of a dug well, this is necessary so that the quality of the well is safe and in accordance with the established rules. [16]

This study is different from previous studies in that from all dug well water samples and the distance between the wells and the sptic tank in the Rap-rap Village, North Minahasa Regency, 12 positive samples contained Escherichia coli bacteria and all did not meet the requirements because they had exceeded the threshold value. [3]

Similar research conducted previously obtained Colliform content of 500-3600 MPN/100 ml in well water from residents of Tembalang District, Semarang City. [8] Furthermore, the research conducted previously obtained 8 well water samples that were positive for Escherichia coli from clean water in the Social Village of Paguyaman, Bualemo Regency [4].

The absence of Escherichia coli bacteria in dug well water in Kota Timur District indicates that the quality of the well water is good, but the findings which are suspected of Enterobacter aerogenes and Klebsiella are still considered by bacteria that can cause other infections. These bakeries can be found living freely and in the digestive tract which can lead to urinary tract infections.

CONCLUSION

Based on the results it can be concluded that:

1. Based on the results of the research on the identification of Escherichia coli bacteria in dug well water in Kota Timur Gorontalo District that has been done, it can be concluded that all or 14 samples do not contain Escherichia coli bacteria.
2. The physical quality of well water in Kota Timur Gorontalo District, there are 14 samples of dug well water which have a distinctive color, namely clear water, and 14 water samples have a distinctive taste of water, namely fresh, and there are no water samples that have an odor.
3. Based on research conducted to see the distance between wells and pollutant sources, from 14 samples all samples do not meet the requirements, it can be seen that all wells have a distance of less than 10 meters. With 9 well septic tank pollutant sources, 4 well samples adjacent to household waste, and 1 well sample adjacent to the cage.

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